

**FCC AMENDED REPORT TO CONGRESS  
ON THE DEPLOYMENT OF E-911 PHASE II SERVICES  
BY TIER III SERVICE PROVIDERS**

**Submitted Pursuant to  
Public Law No. 108-494**

**FEDERAL COMMUNICATIONS COMMISSION**

**April 1, 2005**

TABLE OF CONTENTS

I.	INTRODUCTION .....	1
II.	DEPLOYMENT OF E-911 PHASE II SERVICES BY TIER III SERVICE PROVIDERS .....	3
	(1) The number of Tier III commercial mobile service providers that are offering Phase II E-911 services.....	3
	(2) The number of requests for waivers from compliance with the Commission’s Phase II E-911 service requirements received by the Commission from such Tier III providers. ....	3
	(3) The number of waivers granted or denied by the Commission to such Tier III providers. ....	3
	(4) How long each waiver request remained pending before it was granted or denied.....	4
	(5) How many waiver requests are pending at the time of the filing of the report...	5
	(6) When will the pending requests be granted or denied. ....	5
	(7) Actions the Commission has taken to reduce the amount of time a waiver request remains pending. ....	5
	(8) The technologies that are the most effective in the deployment of Phase II E-911 services by such Tier III providers. ....	6
III.	CONCLUSION.....	11

## REPORT TO CONGRESS ON THE DEPLOYMENT OF E-911 PHASE II SERVICES BY TIER III SERVICE PROVIDERS

On December 23, 2004, Congress directed the Commission to submit a report to the Committee on Energy and Commerce of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate on information related to the deployment of enhanced 911 (E-911) Phase II services by Tier III service providers.<sup>1</sup> In response, we report on the status of E-911 deployment by Tier III carriers,<sup>2</sup> as well as the disposition of requests for waiver of the Commission's E-911 rules filed by Tier III carriers.<sup>3</sup> We also address the technologies available for Tier III carriers to provide E-911 Phase II location information as required by our rules.

### I. INTRODUCTION

The Commission first crafted rules in 1996 to ensure that location information for wireless 911 callers would be provided to 911 call centers, or Public Safety Answering

---

<sup>1</sup> National Telecommunications and Information Administration Organization Act – Amendment, Pub. L. 108-494, § 106, 118 Stat. 3986, 3991 (2004) (ENHANCE 911 Act). Specifically, Section 106 of the ENHANCE 911 Act required the Commission to submit a report to Congress no later than March 23, 2005. Section 106 states:

SEC. 106. REPORT ON THE DEPLOYMENT OF E-911 PHASE II SERVICES BY TIER III SERVICE PROVIDERS.

Within 90 days after the date of enactment of this Act, the Federal Communications Commission shall submit a report to the Committee on Energy and Commerce of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate detailing--

- (1) the number of tier III commercial mobile service providers that are offering phase II E-911 services;
- (2) the number of requests for waivers from compliance with the Commission's phase II E-911 service requirements received by the Commission from such tier III providers;
- (3) the number of waivers granted or denied by the Commission to such tier III providers;
- (4) how long each waiver request remained pending before it was granted or denied;
- (5) how many waiver requests are pending at the time of the filing of the report;
- (6) when the pending requests will be granted or denied;
- (7) actions the Commission has taken to reduce the amount of time a waiver request remains pending; and
- (8) the technologies that are the most effective in the deployment of phase II E-911 services by such tier III providers.

<sup>2</sup> The Commission defines Tier III service providers as non-nationwide Commercial Mobile Radio Service (CMRS) providers with no more than 500,000 subscribers as of the end of 2001. See Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, Phase II Compliance Deadlines for Non-Nationwide Carriers, CC Docket No. 94-102, *Order to Stay*, 17 FCC Rcd 14841, 14848 ¶ 22 (2002) (*Non-Nationwide Carriers Order*).

<sup>3</sup> This amended report replaces a previously submitted version that was provided on March 23, 2005.

Points (PSAPs).<sup>4</sup> The Commission's requirements to provide location information, a capability referred to as Automatic Location Identification (ALI), are comprised of two phases. Pursuant to the Phase I rules, wireless carriers were required to provide a callback number for the handset placing the 911 call and report the location of the cell tower that received the call. The Phase I rules required compliance by April 1, 1998, or within six months of a PSAP request, whichever is later.<sup>5</sup> Under the Phase II rules, Tier III wireless carriers were required to provide more accurate 911 call location information, beginning September 1, 2003, or within six months of a PSAP request, whichever is later.<sup>6</sup> The degree of location accuracy required under the Phase II rules varies, depending on whether the carrier utilizes a network-based or handset-based solution.<sup>7</sup>

The Commission is committed to ensuring that the Nation's wireless telephone users have timely access to emergency services using E-911 technology. In adopting the E-911 rules, however, the Commission recognized that there could be circumstances where deployment of wireless E-911 service might not be technically or economically feasible within the scheduled time periods, and anticipated that it would grant relief in cases where carriers filed waiver requests that met the Commission's standards for waiver relief.<sup>8</sup> Many Tier III carriers have filed requests for waivers or extensions of the Commission's E-911 Phase II deadlines. In making determinations to grant or deny relief, the Commission has balanced its policy objective of ensuring that E-911 Phase II service is deployed as quickly as possible with the financial and technical challenges faced by certain carriers.<sup>9</sup>

---

<sup>4</sup> See Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, *Report and Order and Further Notice of Proposed Rulemaking*, 11 FCC Rcd 18676 (1996) (*E-911 Report and Order*).

<sup>5</sup> See 47 C.F.R. § 20.18(d).

<sup>6</sup> See *Non-Nationwide Carriers Order*, 17 FCC Rcd at 14852-53 ¶¶ 32-33.

<sup>7</sup> See 47 C.F.R. § 20.18(h). Specifically, the standards for Phase II location accuracy and reliability are as follows: (1) for network-based technologies, 100 meters for 67 percent of calls, and 300 meters for 95 percent of calls, and (2) for handset-based technologies, 50 meters for 67 percent of calls, and 150 meters for 95 percent of calls. Network-based location solutions employ equipment and/or software added to wireless carrier networks to calculate and report the location of handsets dialing 911. These solutions do not require changes or special hardware or software in wireless handsets. See 47 C.F.R. § 20.3(c), *Network-based Location Technology*. Handset-based location solutions employ special location-determining hardware and/or software in wireless handsets, often in addition to network upgrades, to identify and report the location of handsets calling 911. See 47 C.F.R. § 20.3(c), *Location-Capable Handsets*. Hybrid solutions combine network-based equipment with handset-based location technologies, and must meet the handset-based accuracy requirements.

<sup>8</sup> See *E-911 Report and Order*, 11 FCC Rcd at 18718 ¶ 84.

<sup>9</sup> See *Non-Nationwide Carriers Order* (granting a temporary stay of the Phase II deployment deadlines); Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, *Order to Stay*, 18 FCC Rcd 20987 (2003) (*Order to Stay*)(describing the criteria necessary for obtaining waivers); Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, E-911 Phase II Compliance Deadlines for Tier III Carriers, CC Docket No. 94-102, *Order*, FCC 05-79 (adopted Mar. 22, 2005)(*2005 Tier III Order*)(addressing numerous requests for waiver of the Phase II service rules).

## II. DEPLOYMENT OF E-911 PHASE II SERVICES BY TIER III SERVICE PROVIDERS

We provide below the specific information requested by Congress in section 106 of the ENHANCE 911 Act. A detailed listing of each Tier III service provider, its filings, and dates of Commission action, is attached as Appendix A.

### **(1) The number of Tier III commercial mobile service providers that are offering Phase II E-911 services.**

Based on their most recent filings or reports to the Commission and publicly available information, out of the approximately 390 Tier III licensees,<sup>10</sup> ten currently are providing Phase II service to at least one PSAP.<sup>11</sup> Six of these service providers provide Phase II service through a handset-based solution, and four through a network-based solution.

### **(2) The number of requests for waivers from compliance with the Commission's Phase II E-911 service requirements received by the Commission from such Tier III providers.**

Over the course of the last five years, 184 requests for waiver relief from the Commission's E-911 rules have been filed.<sup>12</sup>

### **(3) The number of waivers granted or denied by the Commission to such Tier III providers.**

As detailed below, the Commission has addressed a total of 184 requests for relief. Of these, the Commission granted 173 requests, in whole or in part, and denied or dismissed eleven requests.

- a. Prior to the July 2002 *Non-Nationwide Carriers Order*, ninety-eight requests for waiver were filed. In the *Non-Nationwide Carriers Order*, released July 26, 2002,

---

<sup>10</sup> This number is an approximation, based on the best data available to the Commission. The most recent opportunity the FCC had to identify the universe of Tier III carriers was in October 2000, when it required all Tier III carriers to file status reports. At that time, 390 Tier III carriers responded. However, the Commission believes this number has been affected by subsequent mergers, acquisitions and changed business plans.

<sup>11</sup> These carriers, including the states within which they are providing Phase II service, are: Amarillo License, L.P. (Texas); Cellular South Licenses, Inc. (Mississippi, Tennessee, Alabama, and Florida); Corr Wireless Communications, LLC (Alabama); High Plains Wireless, L.P. (Texas); Iowa Wireless (Iowa); North Carolina RSA 1 d/b/a Ramcell of North Carolina; North Carolina RSA 3 Cellular Telephone Company d/b/a Carolina West Wireless; N.E. Colorado Cellular, Inc.; South Canaan Cellular Communications Company LP (Pennsylvania); and Southern Illinois RSA Partnership d/b/a First Cellular of Southern Illinois. In addition, Edge Wireless provides a limited form of Phase II service to four Oregon counties using handsets with a special battery with built-in GPS capability. Because the Commission does not require regular Phase II status reports from Tier III carriers, some carriers may have begun providing Phase II service without notifying the Commission, or since their most recent filings.

<sup>12</sup> Certain requests for relief of the Phase II requirements were filed on behalf of more than one Tier III carrier. Furthermore, while not covered by the requirements of Section 106 of the ENHANCE 911 Act, we note that one petition for forbearance relating to the requirements of Section 20.18(g) of our rules remains pending as of the filing of this report. The Tier IV Coalition filed this petition on December 28, 2004, pursuant to Section 10 of the Communications Act, 47 U.S.C. § 160.

the Commission granted these ninety-eight requests a temporary stay of the Phase II service requirements.<sup>13</sup>

- b. On November 20, 2002, the Tier III Coalition filed a joint request for relief on behalf of twelve service providers, requesting limited forbearance from the Phase II accuracy requirements. In an order released on November 19, 2003, the Commission denied the request for relief.<sup>14</sup>
- c. Between September 2002 and September 2003, forty-four requests for relief were filed requesting the same relief granted in the *Non-Nationwide Carriers Order*. In its October 10, 2003 *Order to Stay*, the Commission granted those requests for relief.<sup>15</sup>
- d. On March 22, 2005, the Commission adopted an order granting, in whole or in part, thirty requests for relief. The Commission denied or dismissed ten other requests for relief.<sup>16</sup>
- e. On April 1, 2005, the Chief, Public Safety and Critical Infrastructure Division, Wireless Telecommunications Bureau, granted a request for relief filed by Chariton Valley Communication Corporation, Inc.<sup>17</sup>

**(4) How long each waiver request remained pending before it was granted or denied.**

As Appendix A shows, the requests for relief addressed in the *Non-Nationwide Carriers Order* remained pending an average of 258 days; those decided in the *Order to Stay* remained pending an average of 143 days. The request for relief filed by the Tier III Coalition addressed in the *Forbearance Order* remained pending for 363 days. The requests for relief addressed in the *2005 Tier III Order* remained pending an average of 591 days. The request for relief filed by Chariton Valley Communication Corporation, Inc. addressed by the Public Safety and Critical Infrastructure Division remained pending for forty-two days. The average number of days that all Tier III requests for relief addressed by the Commission remained pending is 302.

We note that, in many cases, petitioners subsequently amended their initial waiver requests on one or more occasions to inform the Commission of changed circumstances and to adjust their requested relief accordingly. The Commission has examined the record to determine the initial filing dates in light of subsequent supplements, amendments, and related additional filings. In most circumstances, the Commission measured the amount of time any request for relief remained pending based on the date of

---

<sup>13</sup> See *Non-Nationwide Carriers Order*, 17 FCC Rcd at 14852-53 ¶¶ 32-33.

<sup>14</sup> See Petition for Forbearance From E-911 Accuracy Standards Imposed on Tier III Carriers for Location Wireless Subscribers Under Rule 20.18(h), WT Docket No. 02-377, *Order*, 18 FCC Rcd 24648 (2003) (*Forbearance Order*).

<sup>15</sup> See *Order to Stay*, 18 FCC Rcd at 20998-99 ¶ 31.

<sup>16</sup> See *2005 Tier III Order*.

<sup>17</sup> See Chariton Valley Communication Corporation, Inc. Petition for Temporary Limited Waiver of Section 20.18(f) of the Commission's Rules, CC Docket No. 94-102, *Order*, DA 05-1002 (WTB PSCID rel. Apr. 1, 2005).

initial filing. In one proceeding,<sup>18</sup> however, the Commission specifically afforded carriers an opportunity to file new or supplemented waiver requests in response to detailed guidance regarding the appropriate nature and content of such filings.<sup>19</sup> Where carriers elected to take advantage of this opportunity to provide the Commission with a more complete waiver request, the time pending was calculated based upon the submission of such request.

**(5) How many waiver requests are pending at the time of the filing of the report.**

There are no waiver requests pending as of the filing of this amended report.<sup>20</sup>

**(6) When will the pending requests be granted or denied.**

There are no waiver requests pending as of the filing of this amended report.

**(7) Actions the Commission has taken to reduce the amount of time a waiver request remains pending.**

The Commission recently has taken the following actions to reduce the processing time for waiver requests:

- Established an E-911 Task Force of attorneys, engineers and support staff dedicated to expeditious review of E-911 waiver requests.
- Created a database for tracking E-911 specific matters.
- Trained staff to streamline the processing of waiver requests.
- Hired additional management staff to directly oversee E-911 matters.
- Established speed-of-disposal objectives for requests for waiver relief.
- Initiated periodic meetings with handset and other equipment manufacturers to inform FCC staff of the technical, cost and other factors that influence disposition of waiver requests.
- Encouraged carriers to consult with the Commission in advance of filing waiver requests to ensure that the waiver proponent is aware of the need for factual documentation of claims and of the Commission's standards for evaluation of waiver requests.

---

<sup>18</sup> See *Non-Nationwide Carriers Order*.

<sup>19</sup> See Commission Establishes Schedule for E911 Phase II Requests by Small and Mid-Sized Wireless Carriers, CC Docket No. 94-102, *Public Notice*, FCC 01-302 (rel. Oct. 12, 2001); Wireless Telecommunications Bureau Provides Guidance on Filings by Small and Mid-Sized Carriers Seeking Relief from Wireless E911 Phase II Automatic Location Identification Rules, CC Docket No. 94-102, *Public Notice*, DA 01-2459 (rel. Oct. 19, 2001).

<sup>20</sup> While not covered by the requirements of Section 106 of the ENHANCE 911 Act, we note that one petition for forbearance relating to the requirements of Section 20.18(g) of our rules remains pending as of the filing of this report. The Tier IV Coalition filed this petition on December 28, 2004, pursuant to Section 10 of the Communications Act, 47 U.S.C. § 160.

## **(8) The technologies that are the most effective in the deployment of Phase II E-911 services by such Tier III providers.**

### **Introduction**

In considering the technologies that are most effective in the deployment of Phase II E-911 services by Tier III carriers, it is important to recognize that such providers, in general, serve rural markets across the U.S. In choosing among available Phase II E-911 technologies, a carrier's decision reasonably will be affected by such factors such as its air interface,<sup>21</sup> its available infrastructure (*e.g.*, number and location of base stations deployed), and the environmental characteristics of its service area, such as population density and terrain.

In the sections below, we provide an overview of the various solutions that are available to Tier III carriers. We describe how these solutions relate to the particular air interface being employed, and some of the constraints that carriers may encounter.

### **Solutions For Phase II E-911**

As an initial matter, it is important to note that a wireless carrier's E-911 system generally consists of two interconnected segments: the air interface and the fixed, backhaul network<sup>22</sup> over which E-911 voice calls are routed. Regardless of the particular air interface a carrier chooses to employ, the basic structure of the backhaul network is generally the same. Therefore, we will concentrate on the possible solutions for obtaining and transmitting location information over the air interface to ensure the successful provision of Phase II E-911 services.

Carriers have several choices for the air interface they choose to employ. In the United States, the most common air interfaces are Code Division Multiple Access (CDMA),<sup>23</sup> Time Division Multiple Access (TDMA),<sup>24</sup> Global System for Mobile Communications (GSM),<sup>25</sup> Integrated Dispatch Enhanced Network (iDEN),<sup>26</sup> and the

---

<sup>21</sup> In wireless communication systems, the air interface is the radio-frequency portion of the circuit between the handset and the active base station.

<sup>22</sup> A "backhaul network" is the microwave link, fiber, or other wireline connection between individual cell sites and the switch that controls routing of calls.

<sup>23</sup> Code Division Multiple Access is a digital air interface for wireless systems that uses spread spectrum techniques. In a CDMA system, each user uses the full available spectrum, but individual calls are assigned a unique code used to differentiate them. The early version of the CDMA protocol is called IS-95 and uses a bandwidth of 1.25 MHz. A newer, improved version called CDMA-2000 in the U.S. (and WCDMA in Europe) uses bandwidths of 1.25 MHz or more and achieves much higher subscriber capacity than earlier versions.

<sup>24</sup> Time Division Multiple Access is a digital air interface for wireless systems that divides each wireless channel into discrete time slots in order to increase the number of calls that can be carried in a given bandwidth. Individual users are assigned a time slot in a particular channel on which to communicate. Today, the TDMA standard commonly known in North America is IS-136.

<sup>25</sup> The Global System for Mobile Communications is a digital air interface for wireless systems that uses TDMA techniques to divide each channel into eight discrete time slots allowing for up to eight simultaneous calls using the same frequency.

<sup>26</sup> iDEN is a proprietary TDMA-based digital wireless air interface standard designed by Motorola for use on Specialized Mobile Radio (SMR) networks.

original analog Advanced Mobile Phone Service (AMPS),<sup>27</sup> the use of which is rapidly declining. The choice among these specific air interfaces affects the choice of solution for Phase II E-911 deployment.

Carriers have three methods for implementing E-911 solutions: network-based, handset-based and hybrid methods that involve both network-based and handset based aspects. The implementation of a network-based solution involves upgrading network components to obtain information about the location of a handset. Network-based solutions can be accomplished by independently overlaying a network over the existing wireless network, by integrating technology into existing base stations, or by a combination of both steps. Network solutions can be used with any handset because the location is determined by information gathered at the base station receivers. Handset-based solutions require that each handset be equipped with circuitry capable of independently determining the location of the caller and passing this information to a mobile location center for processing. Handset-based solutions require minimal, if any, network upgrades because the location data is determined by the handset and that information can be relayed to the PSAP. Hybrid solutions require modifications to the network and handsets equipped with location-determining circuitry, and determine location based on information gleaned from both elements.

There are a number of technologies available for determining a caller's location after initiating a 911 call from a mobile handset, but the state of their development differs.<sup>28</sup>

- Network Solutions
  - Angle of Arrival (AOA)<sup>29</sup>
  - Uplink Time Difference of Arrival (U-TDOA)<sup>30</sup>
  - Wireless Location Signatures<sup>31</sup>

---

<sup>27</sup> AMPS is the original analog wireless air interface standard used in cellular systems in the U.S.

<sup>28</sup> Because many E-911 solutions exist or are proposed and many continue to be developed, this is not a comprehensive list, but a list of the most common or well-known.

<sup>29</sup> Angle of Arrival technology measures the direction of arrival of the caller's signal (generally at least three measurements are needed) at different cell sites. Each cell site receiver sends this direction information to the mobile switch where the angles are compared and the latitude and longitude of the caller is computed and sent to the PSAP. AOA works with any handset – digital, analog, TDMA, GSM, CDMA, etc.

<sup>30</sup> This is sometimes referred to simply as Time Difference of Arrival (TDOA). Time Difference of Arrival relies on the fact that each cell site is generally a different distance from the caller and that signals travel with constant velocity. Therefore, each signal arrives at the cell site at slightly different times. Using these properties, a signal defines a locus of points on a circle around a base station on which a mobile could be located. Then, using synchronized receivers, the times can be compared and a latitude and longitude can be computed and sent to the PSAP. At least three different receivers are needed for TDOA to work. TDOA works with any handset – digital, analog, TDMA, GSM, CDMA, etc.

<sup>31</sup> Wireless Location Signature methods compare the radio signal received to a database of standard signal characteristics, such as reflections and echoes. Using this information from several cell site receivers, the caller location can be computed and sent to the PSAP. This technique works best in urban environments

- Location Pattern Matching (LPM)
    - Multi-path Fingerprinting (MP)
  - Enhanced Cell Identity (E-CID)<sup>32</sup>
- Handset Solutions
  - GPS<sup>33</sup>
- Hybrid Solutions
  - Assisted GPS (A-GPS)<sup>34</sup>
    - Wireless Assisted GPS<sup>35</sup>
    - TV-GPS<sup>36</sup>
  - Advanced Forward Link Trilateration (A-FLT)<sup>37</sup>
  - Timing Advance/Network Measurement Report (TA/NMR)<sup>38</sup>
  - Enhanced Observed Time Difference (E-OTD)<sup>39</sup>

---

where lots of structures exist to provide the needed reflections. LPM works with any phone – digital, analog, TDMA, GSM, CDMA, etc.

<sup>32</sup> Enhanced Cell Identity uses a combination of angular information (the cell sector receiving the signal) and timing information to approximate the location of the handset.

<sup>33</sup> GPS techniques use handsets equipped with GPS receivers. The GPS receiver determines the caller's latitude and longitude which is sent to the provider's receivers and relayed to the PSAP.

<sup>34</sup> Assisted GPS uses techniques and advanced chipsets designed to allow reception of GPS signals indoors. Assisted GPS can be supplemented with an advanced forward link trilateration (A-FLT) system. A-FLT is a network-based location technology that takes measurements of signals from nearby base stations and reports time and distance readings back to the network, which uses them to triangulate an approximate location of the handset.

<sup>35</sup> Wireless Assisted GPS generally uses advanced chipsets capable of acquiring very weak GPS signals and integrating the signals very quickly to determine location.

<sup>36</sup> TV-GPS uses synchronization signals from television stations to determine handset location when indoors. Because of the frequency and power of TV signals, they often can be received at indoor locations where GPS signals cannot.

<sup>37</sup> Advanced Forward Link Trilateration is a handset-based position location technology that works by using measurements, taken by the handset, of signals from nearby base stations, and reporting the time/distance readings back to the network, which are then used to triangulate an approximate location of the handset. In general, at least three surrounding base stations are required to obtain an optimal position fix.

<sup>38</sup> This method relies in part on timing advance, which is the maximum amount of time that a TDMA mobile station uses to compensate for propagation delay in order to avoid user time slot overlap when the mobile is far away from the base station. It also employs information from the Network Management Report, which is the measurement done either at the handset or base stations to improve communication flow on the air interface. Various events – such as handoff, power control, and candidates list – use the Network Management Report.

<sup>39</sup> Enhanced Observed Time Difference measures the differences in time that signals from the base stations take to reach both the handset and a fixed point in the network. This information is then sent from the

## **Network based Solutions**

Network based E-911 location systems employ specialized equipment capable of capturing signals from a mobile unit that initiates a 911 call and use the signal attributes to determine the mobile location. Ideally, this equipment is located at existing base stations so that the existing antennas and RF circuitry can be used, thus minimizing deployment cost. However, in some cases, new receive-only sites must be used to provide the required degree of location accuracy.<sup>40</sup>

The primary advantage of network based solutions for E-911 is that they can work with any handset regardless of type or age. This is because all the processing to determine mobile location is done by the network using properties of the received mobile signal. Thus, network solutions allow more rapid Phase II implementation. But network based solutions do require modification of a carrier's network sites. However, cost and accuracy of the various techniques employed for network E-911 solutions can differ substantially. Generally, network solutions tend to be less accurate than handset based solutions. Depending on the technology and the implementation, the accuracy of network solutions may only approach certainty within approximately 30 meters under ideal circumstances.

## **Handset based Solutions**

Handset techniques rely on the use of a handset that includes specialized chipsets capable of calculating its own position. Accordingly, handset solutions generally take more time to deploy than network based solutions because most customers must be supplied with new handsets. However, handset-based solutions generally do not require the network upgrades, including sophisticated processing capabilities, inherent with network based solutions. The location uncertainty for a GPS handset operating with clear view of the GPS satellite constellation can be very small (easily less than 10 meters). However, in less ideal operating circumstances, the GPS handset may have significant problems providing accurate location information. As with network solutions, handset solutions, and the combination of either solution with air interface measurement characteristics, have varying degrees of cost and accuracy.

## **Hybrid Solutions**

Hybrid solutions obtain location by collecting measurement information from both the wireless network and the handset. They provide flexibility to allow the location derivation to be built on a variety of configurations where measurements can be performed at the handset, or the base station, or both. The leading hybrid solution is A-GPS. This technology uses carrier network signals to supplement and enhance the standard handset based GPS information and improves both the location accuracy and the areas of coverage normally available to the standard GPS device. It enables location

---

handset and the fixed point to a mobile location center where a latitude and longitude are computed and sent to the PSAP.

<sup>40</sup> Network based solutions generally rely on triangulation techniques which provide more accurate location estimates as the number of sites used and their location diversity increases. Because rural areas generally have a low density of base stations it may be necessary to install some receive-only sites to ensure the ability to determine handset location.

determinations to be made under conditions that normally impair reception of the satellite signals such as urban canyons, and inside structures such as buildings or parking garages, or where the GPS signal is affected by multipath fading. Hybrid solutions can be more robust than either the network or handset solutions alone, since they provide a redundant location capability that can accommodate equipment outages or standard system repair and reconfiguration. Hybrid technologies such as A-GPS also provide very small location uncertainties but over much broader coverage conditions than the standard handset solution.

### **E-911 Solutions for Tier III Carriers**

The Commission recognized that various technical approaches have their respective advantages and disadvantages and that competitive development of different approaches was most likely to lead to the provision of accurate Phase II location information to PSAPs, and, accordingly, did not mandate the use of any particular technical approach. Instead, the Commission found that, so long as they meet particular accuracy and performance requirements, any of these approaches will further the public interest.<sup>41</sup> Depending on the technology employed, the carrier must identify the location of the caller within certain accuracy and reliability standards. In recognition of the fact that handset based technologies generally require a longer phase-in period, the Commission established a tighter accuracy standard for handset based solutions.<sup>42</sup>

The Commission recognized that each type of solution has certain characteristics that are particularly relevant for Tier III carriers in rural areas.<sup>43</sup> For example, network-based solutions may not be feasible in many rural wireless networks because the topography of such networks often does not permit sufficient triangulation. Because base stations in many rural areas are located along highways, they often do not have much geometric diversity, which hampers the ability to triangulate a signal to obtain a location.<sup>44</sup> Similarly, wireless location signature techniques that rely on signal reflections are not as well suited to rural areas, as compared to urban environments, because rural locations do not have many obstacles to create these reflections. However, handset based solutions often are well-suited to rural areas because GPS satellites usually will be easily visible by a handset, that is, not obstructed by tall buildings.<sup>45</sup> Network based solutions AOA and TDOA, which rely on direct line of sight from the handset to the base station, are likely to be better network based choices for Tier III carriers than location signature techniques that rely on reflections. Furthermore, there are difficulties with using network based technologies for the CDMA air interface, because CDMA does not readily permit

---

<sup>41</sup> See Revision of the Commission's Rules to Ensure Compatibility with Enhanced 911 Emergency Calling Systems, CC Docket No. 94-102, *Third Report and Order*, 14 FCC Rcd 17388, 17395, 17404-05 ¶¶ 14, 32-33 (1999) (*Third R&O*). The Commission continues to allow any location technology to be used that can comply with specified accuracy, reliability, and deployment schedule requirements. See *Non-Nationwide Carriers Order*, 17 FCC Rcd at 14841-42 ¶ 2 (2002).

<sup>42</sup> See *Third R&O*, 14 FCC Rcd at 17392 ¶ 9. See also *supra* note 6.

<sup>43</sup> See *Third R&O*, 14 FCC Rcd at 17391 ¶ 6.

<sup>44</sup> See *id.* at 17391, 17400 ¶¶ 6, 23.

<sup>45</sup> See *id.* at 17400 ¶ 24.

signals to be easily received or monitored at more than one base station, a requirement for most network based solutions.<sup>46</sup> A disadvantage of handset based solutions is that they require the replacement or upgrading of handsets already in use.<sup>47</sup>

In selecting a location technology, another key element for Tier III carriers is the relative state of development of the various technical solutions for their particular air interface. In many instances, the selection of technical solutions by the nationwide (Tier I) carriers, with whom the Tier III carriers both share air interfaces and have roaming agreements, has driven the development and deployment, and thus the availability, of particular technical solutions.<sup>48</sup> Generally, CDMA and iDEN carriers deploy an A-GPS handset based location technology, in some cases supplemented by A-FLT. The two largest Tier I CDMA carriers, Sprint and Verizon Wireless, use A-GPS. The nationwide TDMA and GSM carriers deploy network based location technologies, such as TDOA, etc. Cingular and T-Mobile use the TDOA network based location technology. The technology chosen by the major carriers can be particularly important for Tier III carriers because the resources required to implement an E-911 system can be substantial and each technology choice and speed of implementation presents its own resource challenge. Rural carriers thus may often leverage the extensive resource investments by the major carriers, and need not expend time and resources in investigating the performance of the universe of location technology choices.

### **Summary**

As explained above, there are many technologies that have the capability of providing Phase II E-911 location information – each with its respective advantages and disadvantages. The Commission has not mandated the use of any particular technical approach, but has established accuracy and performance measures so that any approach implemented must further the public interest. Within the public policy parameters set by the Commission, the best choice for Tier III carriers – as described above – will depend on these factors. In the end, there is no one solution that is necessarily better than another. Each Tier III carrier must assess its own situation in terms of geography, technology, economics, and ease of implementation to determine which solution for Phase II E-911 best complies with the Commission’s Phase II accuracy requirements.

### **III. CONCLUSION**

The Commission is firmly dedicated to ensuring the widespread and rapid deployment of wireless E911 services and, as this report demonstrates, is committed to working closely with Tier III carriers to balance this important public policy objective with the unique needs and individual challenges faced by small wireless carriers.

---

<sup>46</sup> See *id.* at 17402 ¶ 26.

<sup>47</sup> See *id.* at 17404 ¶ 31. Additionally, Tier III carriers that have selected a handset-based solution have had to upgrade their networks to a new air interface such as CDMA or GSM. See *2005 Tier III Order* at §§ III. A, D, and E.

<sup>48</sup> The Commission has found that handset vendors and network-based location technology vendors give priority to the larger, nationwide carriers, whose deployment schedules have created downstream delays. See *Non-Nationwide Carriers Order*, 17 FCC Rcd at 14844 ¶ 11.

Further, consistent with the requirements of the ENHANCE 911 Act, the Commission is taking steps to ensure that it responds swiftly to requests for relief filed by Tier III carriers. The Commission is pleased to have provided this information and will continue its ongoing efforts to foster the deployment of Phase II E911 service by Tier III carriers.